



Experiment 2 - Ferrofluid Spikes

Materials

- EMG-905, a mineral oil-based ferrofluid with a saturation magnetization of 400 gauss obtained from [Ferrofluidics Corporation](#).
- Strong magnet (cow magnet, bar magnet, or rare earth magnet). [Click here](#) for magnet suppliers.
- Petri dish

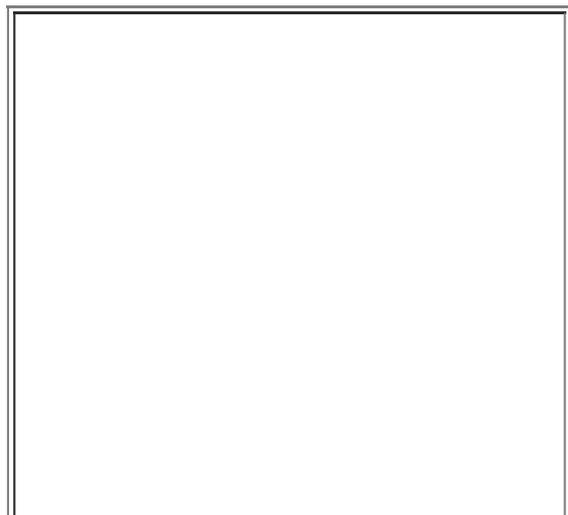
Caution! Caution! Caution! Caution! Caution! Caution! Caution! Caution!

The ferrofluid causes stains and is difficult to remove from skin and fabrics. Keep the fluid off the magnet. It is virtually impossible to remove ferrofluid after direct contact with a strong magnet.

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Procedure

- Pour a small amount of ferrofluid into a Petri dish, so that the bottom of the dish is covered.
- Bring a strong magnet up **underneath** the Petri dish. Spikes of ferrofluid will rise up from the surface.



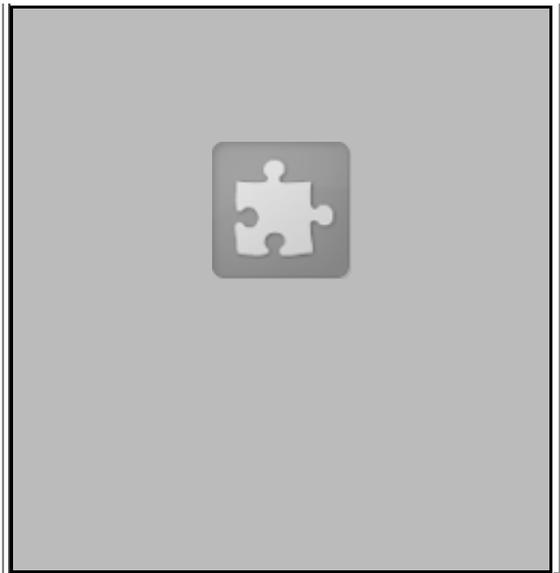


Figure 1 - Click on the arrow on the left to see what happens when a strong magnet is placed under this dish of ferrofluid.

As the magnet is brought closer to the *bottom* of the Petri dish, first one spike appears, then several spikes appear, until the spikes appear to close-pack, with any given spike having six nearest neighbors arranged in a regular hexagon. The pattern of spikes appears because the ferrofluid arranges itself along the magnetic field lines of the magnet (as do iron filings). The number of visible spikes reflects the strength of the magnetic field and the surface tension of the medium.

- Place a cow magnet horizontally *underneath* the Petri dish. A pattern of spikes will appear at the two poles of the magnet. If no spikes are seen, try using a stronger magnet, as this behavior depends on both the strength of the magnetic field and the magnetic strength of the ferrofluid.



Figure 2 - Ferrofluid pattern created by an array of three "ringed" cow magnets.

- Place small, powerful magnets in patterns such as letters underneath the petri dish. The patterns will transfer to the ferrofluid.

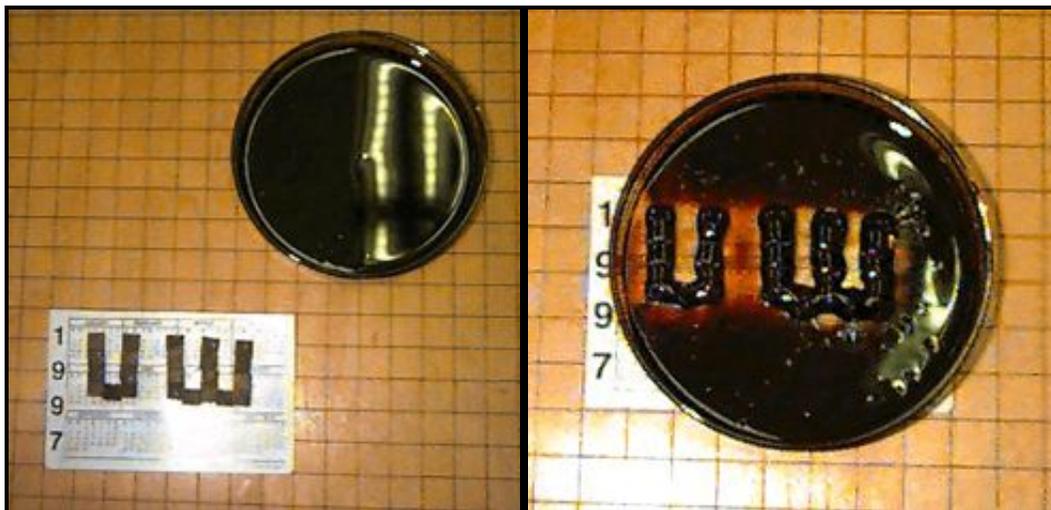


Figure 3 - (left) Place strong magnets in a pattern, such as the "UW" shown. (right) The magnetic field pattern is manifested in the ferrofluid.

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See also *On the Surface of Things* by F. Frankel and G.M. Whitesides. Copyright © 1997, Chronicle Books, San Francisco, CA.

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